Change is Coming:
z/OS Mail Overview and Futures
(Including Motivations and Considerations for migrating from SMTPD/Sendmail to CSSMTP)

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Mail: We must have it!

- Internet Mail:
  - Life-line for communications
  - Critical for business

- Most have no concern for how it is transported through the internet and have no need to understand the details
  - It is just sent and received!

- Typically some administrator in the enterprise datacenter has responsibility for the configuration and setup of mail

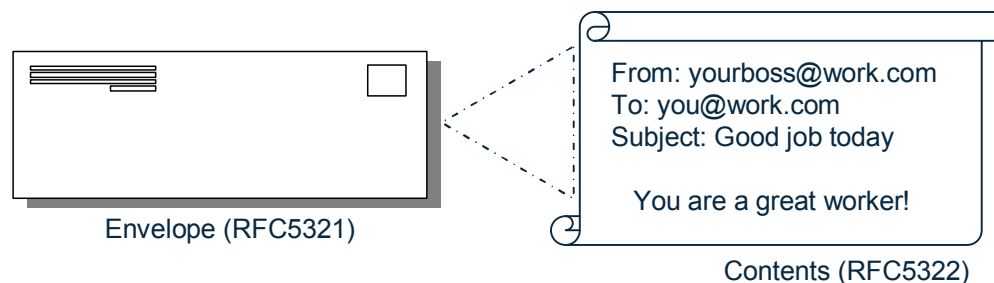➢ Important changes are coming with z/OS Mail

Agenda

- Quick review of Mail standards and terminology

- Overview of the major Mail transports on z/OS

- Discuss the changes that are coming for the Mail transports on z/OS

Quickly..
Brushing up on the Standards

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Internet Mail Standards

1. Internet mail is based upon a set of IETF standards. There are several, but a few are foundational:

   – RFC5321 (based upon RFC's 2821 and 821)- defines the Simple Mail Transfer Protocol (SMTP). TCP-based protocol (reliable). Defines the standards for communication between the mail client and server.

   – RFC5322 (based upon RFC's 2822 and 822)- defines the format of text messages exchanged.

   – RFC6409 – Message Submission Protocol which defines the process that extend the MTA (Mail Transport Agent) role for message submissions from MUAs (Mail User Agents). Focus on more validation where mail is submitted.

From: yourboss@work.com
To: you@work.com
Subject: Good job today

You are a great worker!

Envelope (RFC5321)

Contents (RFC5322)

Mail Transport Applications and Terminology

2. Several types of "agents" play roles in the submission, transport, and delivery of mail. These implement the mail standards (standards define these):

- **Mail Transfer Agent (MTA):**
    - Performs the SMTP protocol in both client and server roles. Listens on well-known port 25.
    - Responsible for transport and delivery of mail. Typically acts as a relay.
    - Uses Domain Name Server (DNS) to resolve recipients and then sends to next hop MTA

- **Message Submission Agent (MSA):**
    - MSA defines a more specific role for the MTA. The MSA performs in the SMTP server role where the mail message enters the systems (from the MUA).
    - MSA Listens on port 587 for incoming connections from the SMTP client .
    - Once the MSA receives the message, then the host will typically become MTA performing delivery or performing as an SMTP client to relay.

- **Mail User Agent (MUA):**
    - Program used to send and read mail (Lotus Notes, Outlook, Thunderbird).
    - May include or invoke an SMTP client which then connects to an MSA to send a message
    - Typically uses the POP protocol as a client to receive email from the host running the POP server where the user's mailbox resides.

- **Mail Delivery Agent (MDA):**
    - At the final destination (target mailbox), the MTA invokes a local program called the "delivery agent" to deliver the message to the recipient's mailbox.

How does your message get to the final destination(s)?

From: sarah@miami.com
To: sue@dallas.com,
cc: kay@austin.com
Subject: Great work

You get a raise!
Thanks, Sarah

1. User (Sarah) constructs an email message using an MUA like Lotus Notes
   - The message is sent to one or more recipients (To: Sue in Dallas cc: Kay in Austin)
   - The SMTP client with her MUA, connects to port 587 on the listening Message Submission Agent (MSA) to sent the mail
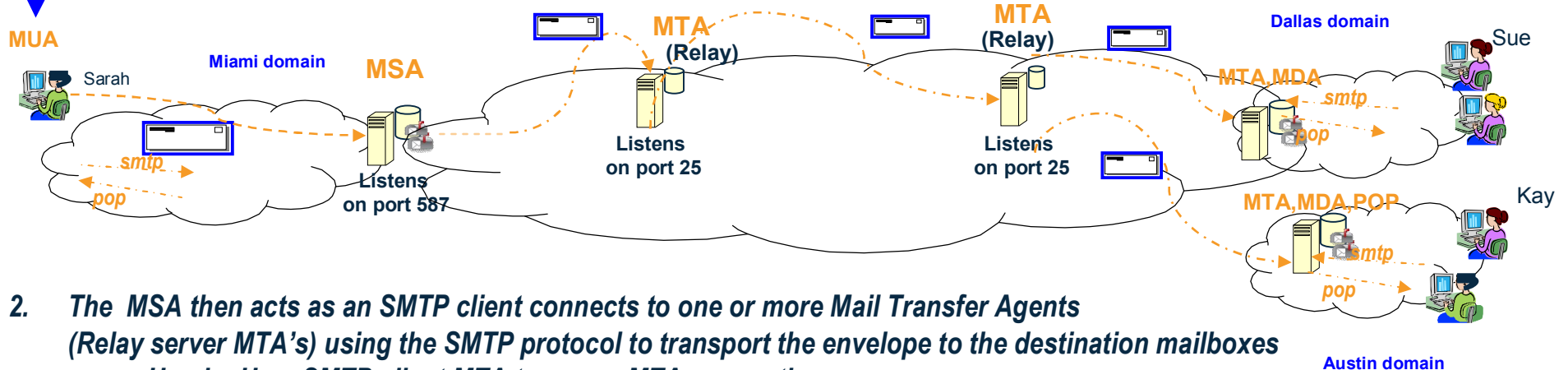
2. The MSA then acts as an SMTP client connects to one or more Mail Transfer Agents (Relay server MTA's) using the SMTP protocol to transport the envelope to the destination mailboxes
   - Hop by Hop, SMTP client MTA to server MTA connection

   ➢ The Domain Name System (DNS) is a critical component since it assists the MSA/MTA's with determining the next hop MTA. Using MX lookup.

3. Finally the mail is delivered to the users' mailboxes (Sue and Kim)

4. The end user then uses an MUA which uses the POP (Post POffice Protocol) to access the mailbox

IBM's z/OS SMTP-based Mail Transport Applications

Sendmail

SMTPD

CSSMTP

Sendmail

- Ported from the popular sendmail.org, today known as "Open Source Sendmail".
  - z/OS Comm Server ported at the 8.12.1 level (2001) and years from current

- Robust mail agent support for transporting mail messages
  - Implements Internet Standards for Internet mail
  - Sendmail supports most of the mail "agent" roles (MSA, MTA). Its "role" depends upon the options with which it is started.
    - The sendmail command can be used to send an email message, performing as an SMTP client communicating to an SMTP server .
    - Sendmail daemon can be used to listen on port 587 (MSA) or port 25 (MTA Relay).
  - Supports other features like mail filtering (Milter API), TLS/SSL
    - Sendmail typically uses the OpenSSL library for TLS/SSL, but on z/OS, System SSL is used to secure the SMTP connection

- Sendmail is primarily used to send mail from z/OS using the simple sendmail client program; however, it can be used to deliver mail to z/OS Unix mailboxes
  - **Ex: sendmail –t < mymsg.txt from unix shell**

- Robustness of Sendmail makes it very powerful functionally, but very complicated to configure and exploit those functions

SMTPD NJE Mail Gateway Application

1. Performs as a **gateway** for sending mail messages from the local or NJE host (JES) to the TCP/IP network using the SMTP protocol
   - Batch jobs or TSO users using SMTPNote allocate sysout datasets containing one or more mail messages to spool.
     - The destination for the dataset is the SMTPD application defined as an external writer.
     - Each message contains the SMTP protocol commands along with the mail body.
   - SMTPD reads each sysout dataset and processes each mail message
   - Functions as an MTA in the SMTP client role to send the message from z/OS

2. Performs as a full Mail Transfer Agent (MTA) acting as both an SMTP client and server
   - Listens on port 25, accepting connections from smtp clients which may be remote or local to z/OS (such as the z/OS Sendmail client)
     - Receives mail to z/OS for delivery to TSO users or for relaying/forwarding to the next hop MTA (Typically will use DNS to find the next hop MTA)
     - Requires z/OS DASD to store while processing messages until delivery

➤ SMTPD is a very old application and has many shortcomings, but has been the primary mail transport on z/OS
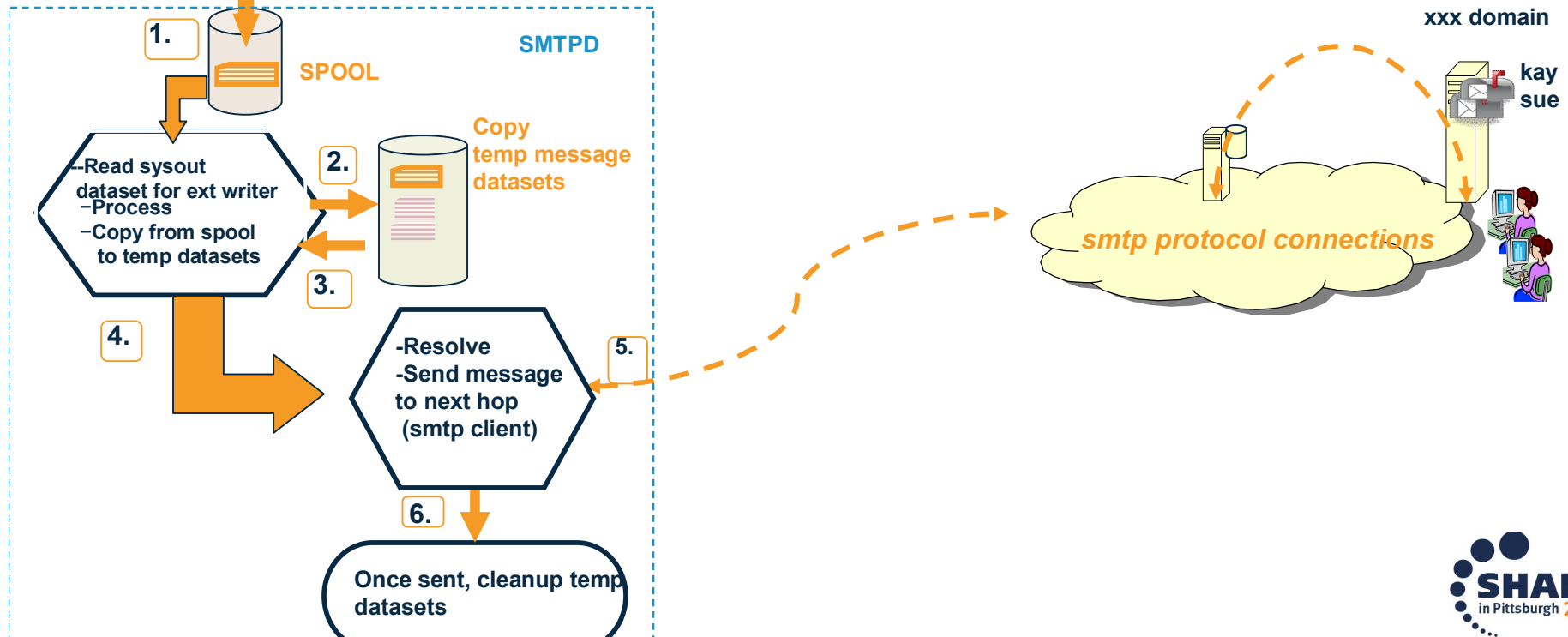
SMTPD Role: NJE Gateway

Batch Job

EHLO
MAIL FROM: me@ibm.com
RCPT TO: kay@xxx.com
RCPT TO: sue@xxx.com
DATA
Date: Thur, 26 Mar 99 …
From: xx@xxx.com
To: kay@xxx.com
Cc: sue@xxx.com
Subject: account updates
   overdraft
QUIT

SMTP protocol commands in blue text

} body

SMTPD

1. SPOOL

2. Copy temp message datasets

–Read sysout dataset for ext writer
–Process
–Copy from spool to temp datasets

3.

4.

–Resolve
–Send message to next hop (smtp client)

5.

6.

Once sent, cleanup temp datasets

xxx domain

kay
sue

smtp protocol connections

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SMTPD Role: SMTP Relay with Sendmail Client

MyApplication

sendmail –t < msg.txt

From: me@xxx.com
To: kay@xxx.com
Cc: sue@xxx.com
Subject: account updates
   overdraft

➢Note: MyApplication could be running on z/OS or distributed
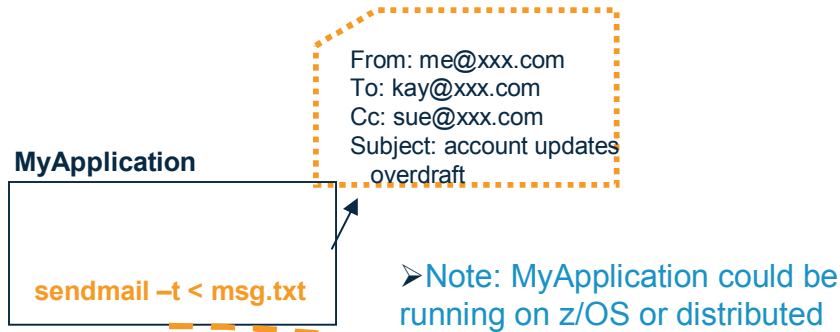
1. *Sendmail smtp protocol connection*

➢**Notice: Steps 3-6 are the same in this example and the previous.**

➢**Note: SMTPD can't send the message, it will retry (steps 3-5)**

SMTPD

SMTP Server:

-Listen (Port 25)

2.

3.

Copy temp message datasets

4.

Send message to next hop (smtp client)

5.

smtp protocol connections

xxx domain
kay
sue

6.

Once sent, cleanup temp datasets
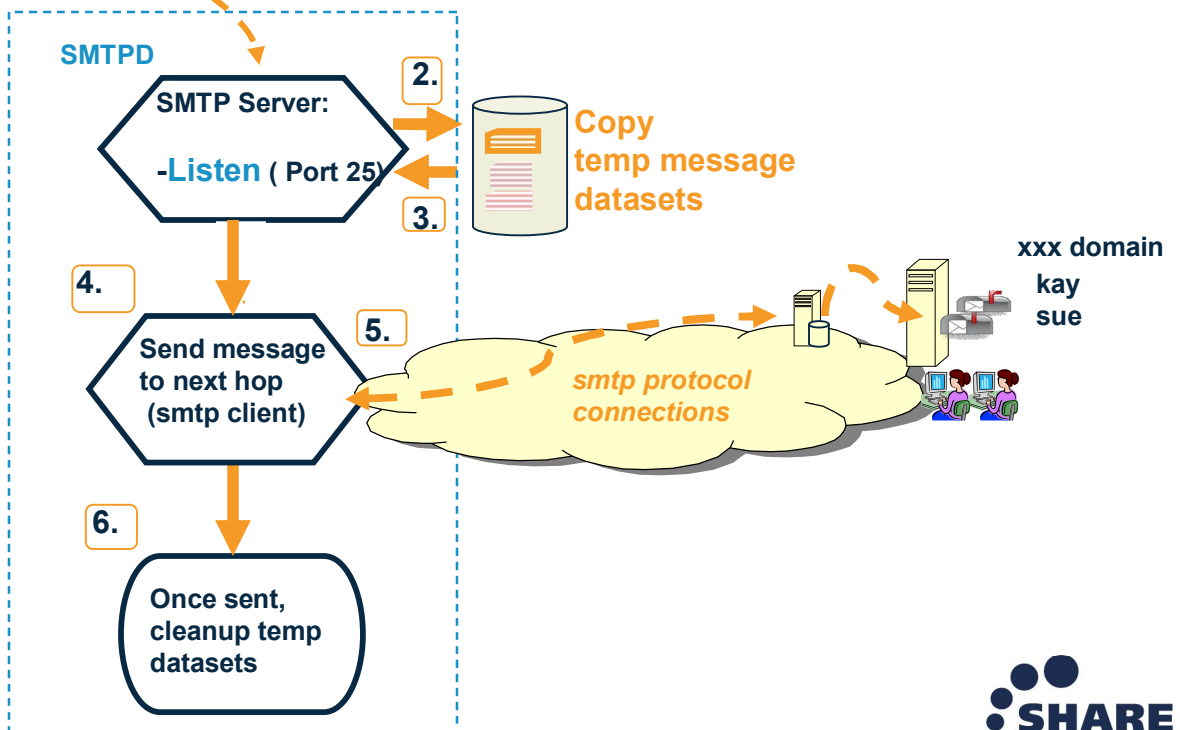
SMTPD
Aging Transport; Significant Challenges to Modernize

- SMTPD's aged implementation prevents enhancements for exploitation of key requirements
  - IPv6
  - TLS/SSL support for securing the SMTP connection

- Poor Performance
  - Designed to have heavy reliance on I/O stores all datasets from spool to disk; therefore, requires configuration of permanent storage (DASD) for message store (temporary datasets).
  - Inefficient ,single-threaded runtime processing model – services spool, SMTP, and message store.

- Requires starting the VMCF and TNF subsystems

- Support for IETF Mail standards are not up to date

- No SMF record support to allow for auditing

- Operator commands are very not robust

- Does not use system translation services (iconv)

How to Addresss SMTPD Challenges?

- A critical mail transport on z/OS, especially with the NJE SMTP Gateway role

- Has many customer requirements for new/enhanced function, primarily for:
    - Improving performance
    - Support for newer Internet mail standards including support for TLS/SSL
    - Improving usability and management features

- ➢ Real inhibitors to updating SMTPD:
    - Many design challenges to overcome
        - Not cost-effective to rewrite since the application design is poor given the advancements in system technology

    - Real need to take action for an improved NJE SMTP Gateway and enterprise class MTA worthy of z/OS customers since mail is business critical
        - Sendmail does not meet requirements to fully/efficiently replace

z/OS CSSMTP Mail Application

Introduced in z/OS V1R11
as strategic replacement for
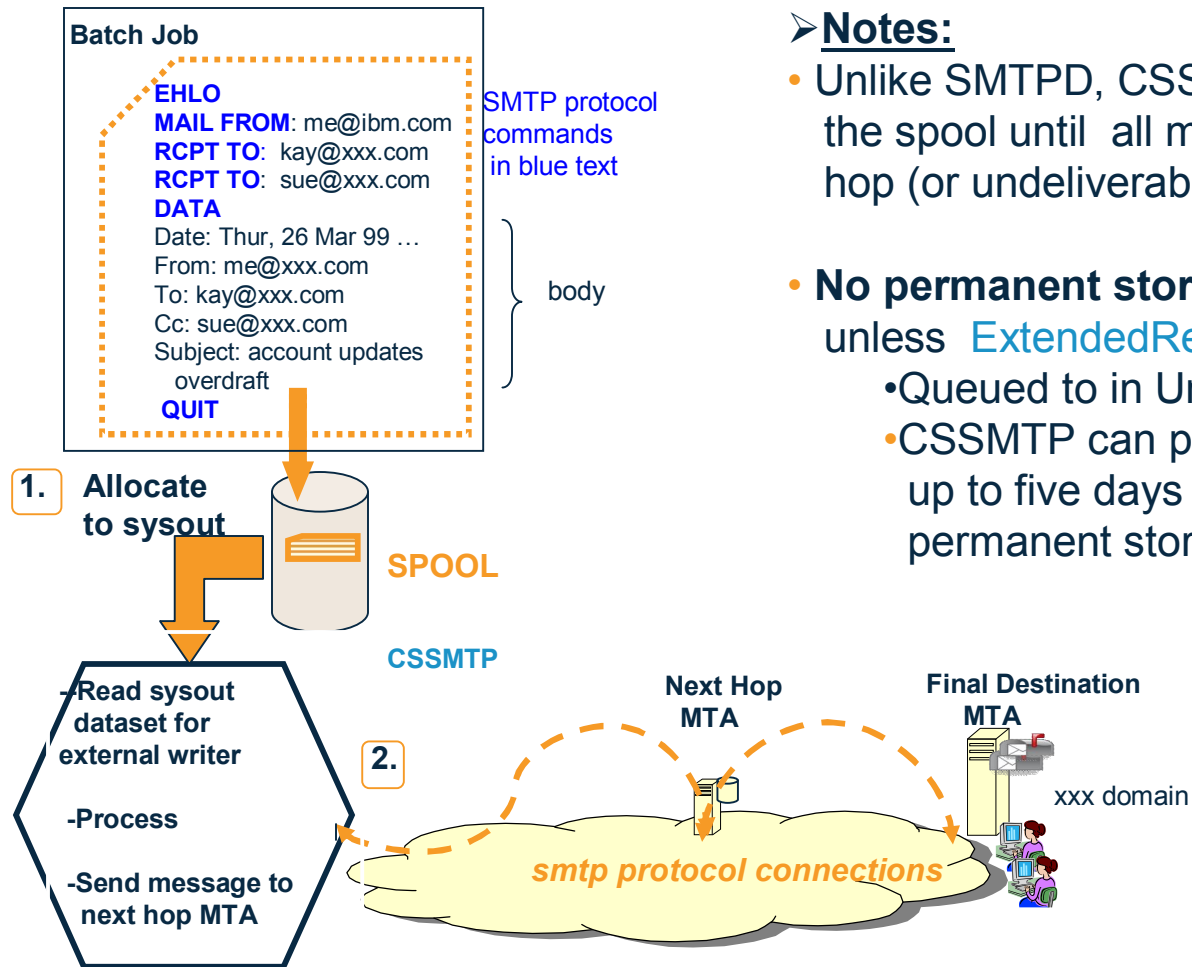## SMTPD NJE SMTP Client Gateway

CSSMTP NJE Mail Gateway Application

➢ Created to replace SMTPD and address many of its shortcomings

- Not a full "functional" replacement for SMTPD; however, supports key functional requirements allowing most all z/OS customers a full and easy migration

- Like SMTPD, CSSMTP performs as a **gateway** for sending mail messages from the local or NJE host (JES) to the TCP/IP network using the SMTP protocol

  - z/OS batch applications allocate syout datasets to spool containing one or more mail messages. The destination is the CSSMTP external writer.

  - Each message contains the SMTP protocol commands along with the mail body.

  - Each dataset is read and the mail messages are processed

  - Connects as an SMTP client to an MTA that is a Relay (Smart Host) as the next hop.

    - CSSMTP will not resolve each recipient in the mail message!

- Unlike SMTPD does not support full Mail Transfer Agent (MTA) capabilities in that it does not support the server MTA role (ie. Does not perform as a listener)

  - Only performs as an SMTP client

    - After the mail message is read from spool, performs the SMTP client role and connects to a remote server MTA (could be local SMTPD or Sendmail) and sends the mail message

➢ **SMTPD and CSSMTP can coexist as NJE SMTP Client Gateways!**

CSSMTP as SMTP NJE Gateway

Batch Job

EHLO
MAIL FROM: me@ibm.com
RCPT TO: kay@xxx.com
RCPT TO: sue@xxx.com
DATA
Date: Thur, 26 Mar 99 …
From: me@xxx.com
To: kay@xxx.com
Cc: sue@xxx.com
Subject: account updates
    overdraft
QUIT

SMTP protocol commands in blue text

} body

1. **Allocate to sysout**

SPOOL

CSSMTP

-Read sysout dataset for external writer

-Process

-Send message to next hop MTA

2.

Next Hop MTA

Final Destination MTA

xxx domain

smtp protocol connections

➢**Notes:**
• Unlike SMTPD, CSSMTP will keep the dataset on the spool until all messages are sent to the next hop (or undeliverable)

• **No permanent storage required** outside of spool, unless ExtendedRetry is required
  • Queued to in Unix file system
  • CSSMTP can perform long retry (LongRetry) of up to five days without requiring additional permanent storage

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Migrating from SMTPD to CSSMTP
Deep Dive into Functional Comparisons

Encourage Migration from SMTPD to CSSMTP

- CSSMTP does not support all features of SMTPD

- Design points targeted such that most users will migrate easily
  - Both applications can coexist. This can help with migration.

- Requires an administrator to read and understand requirements for configuration and setup. Refer to:
  - z/OS Communications Server IP Configuration Guide
  - z/OS Communications Server IP Configuration Reference

- The following slides provide a summary and comparison of function
  - CSSMTP provides superior function for sending mail
  - Also refer to z/OS Communications Server IP Configuration Guide, chapter on "Mail on z/OS".

Mail Agent Roles Comparison

SMTPD   vs   CSSMTP

- The SMTPD NJE SMTP Gateway

- SMTPD provides a full Mail Transfer Agent (MTA) acting as both an SMTP client and server:
  – Client: Removes mail from spool datasets and sends mail from z/OS
  – Server: Listens for incoming SMTP connections (ex: delivers to TSO users)

- Provides forwarding to a next hop relay
  – Does support lookup for each recipient

- CSSMTP NJE SMTP Gateway

- Provides MTA role as the SMTP client sending to next hop MTA:
  – Client: Reads messages from spool datasets and sends from z/OS
  – Server: Not supported. Does not listen for SMTP connections
    - Can't receive undeliverable notifications. Sender's address should be on another system.

- Provides "forwarding" role where requires a next hop relay.
  – Does not resolve recipients!

SMTP Protocol Commands and Processing Related to Standards

SMTPD   vs   CSSMTP

- Does not support latest Internet Mail standards. Supports RFC821 and RFC822.

- Lenient processing headers and body
  - Cases where allows messages not in line with standards

- Supports delivery to TSO users.
  - Supports both internet domain names and userid%NJEdomain

- Provides support for header rewrite-target tso user to internet user

- Supports newer mail standards RFC2821 and RFC2822.
  - Disallows source routing

- Stricter compliance with RFC2822.
  - Helps to ensure cleaner processing by next hops

- No support for delivery to TSO users.
  - Only supports internet domain names for senders, recipients, and postmaster.
  - No support for userid%NJEdomain

- No support for header rewrite

SMTPD   vs   CSSMTP

- Support translation (EBCDIC to ASCII) of messages with translation tables (library), but doesn't use ICONV(modern platform translation services)

- Supports the ability to translate using ICONV and to specify the codepage to translate to US-ASCII).
  - SMTPD tables are not supported.

- Supports ATSIGN configuration statement.

- No support for ATSIGN configuration statement. Use **Codepage** to perform translation.

Application Performance and Ability to Ensure Message Delivery

SMTPD   vs   CSSMTP

- Requires z/OS DASD (MVS dataset) to store message until sent
  - Heavy I/O requirements
  - Tries to send until success or eventual failure

- No requirements for z/OS DASD
  - Efficient processing of messages in memory and automatic quiescing of spool processing when private storage is at 75% utilization (could be due to slow target server) . APAR V1R12: PM92166
  - Messages remain on spool until sent (or fail)
  - If target servers unreachable, then reading of spool is quiesced until a server is available.
  - Support for "long"/"extended" retry where target servers have resource issues. For "extended", can define a message store in Unix file system allowing CSSMTP to remove datasets from spool
  .

- No support for message Checkpointing. If SMTPD is restarted, messages must be reprocessed.

- Supports message Checkpointing so that if CSSMTP is restarted messages are not reprocessed

Head to Head Performance Comparisons

- In performance comparisons sending 4000 emails
  - CSSMTP was 4.5 times faster than SMTPD
  - CSSMTP used half as much CPU

CSSMTP

Securing Mail Transport and Who can Send Mail

SMTPD   vs   CSSMTP

- No support for security the SMTP connection with TLS/SSL and no support for SMTP STARTTLS.
  - Unable to use AT-TLS

- Supports a Security Exit

- Support for SECURE and RESTRICT configuration statements to restrict senders (mail from) and receivers (rcpt to)
  - No SAF controls

- Support for securing the SMTP connection with TLS/SSL. Support for RFC3207 (SMTP STARTTLS)
  - Uses AT-TLS

- Supports a Security Exit with many enhancements.
  - SMTPD exits can migrate easily.

- Provides a SERVAUTH SAF profile. CSSMTP will only read spool datasets where the user that allocated the dataset is permitted to the SERVAUTH profile.
  - No controls around the sender or recipients in the message.

Systems Management and Miscellaneous Features

SMTPD   vs   CSSMTP

- Limited support for console command displays

- No support for SMF records

- No Support for IPv6

- Robust console command support for displays and modify

- Robust support for SMF records

- Support for IPv6

Future and Strategy

z/OS Mail Transports

z/OS Strategy for Mail Transports

- **IBM has issued a formal Statement of Direction to remove Sendmail and SMTPD from z/OS**
  - Allow time for planning
  - CSSMTP is the strategic mail transport on z/OS
    - Supports primary use cases for "majority" of z/OS customer

➢ IBM understands that there will be impacts to removing these applications since it is recognized that CSSMTP does not currently address all functional gaps
  - Require feedback from our users
  - Continue to gather information on severity of impact to business

Removal of SMTPD NJE Mail Gateway and Sendmail mail transport from z/OS Communications Server:

It is the intention of IBM to remove the Simple Mail Transport Protocol Network Job Entry (SMTPD NJE) Mail Gateway and Sendmail mail transports from z/OS Communications Server in the future. If you use the SMTPD NJE Gateway to send mail, IBM recommends you use the existing CSSMTP SMTP NJE Mail Gateway instead. CSSMTP provides significant functional and performance improvements. The Sendmail client program can also be used to send mail messages; a replacement function using CSSMTP as the SMTP transport is planned. This function will be designed so that it does not require application programming changes. No replacement function is planned in z/OS Communications Server to support using SMTPD or Sendmail as a (SMTP) server for receiving mail for delivery to local TSO/E or z/OS UNIX System Services user mailboxes, or for forwarding mail to other destinations.

Impacts of Removing Sendmail and SMTPD

➤ **Three major areas of consideration:**

1. **Removes platform provided SMTP server (listener) support:**
   - Products that use an smtp client on z/OS will be required to connect directly to a remote mail server (ex: mail server on zLinux)
     - Ex: products using sendmail client, java mail, other product-embedded clients
   - Users should consider use cases where functions use a local SMTP client may depend upon a local server for high availability
   - In the case of SMTPD, no support for delivery of mail to TSO users

2. **Sendmail command is an SMTP client used to send mail**
   - Used by z/OS programs (tooling, scripts, program products) to sendmail and would have serious impact if removed
   - Typically connects to the sendmail or SMTPD server locally

3. **Migrating from SMTPD to CSSMTP in a production environment**
   - Don't want to impact production mail processes. No easy way to test and ensure production mail will be sent with CSSMTP.
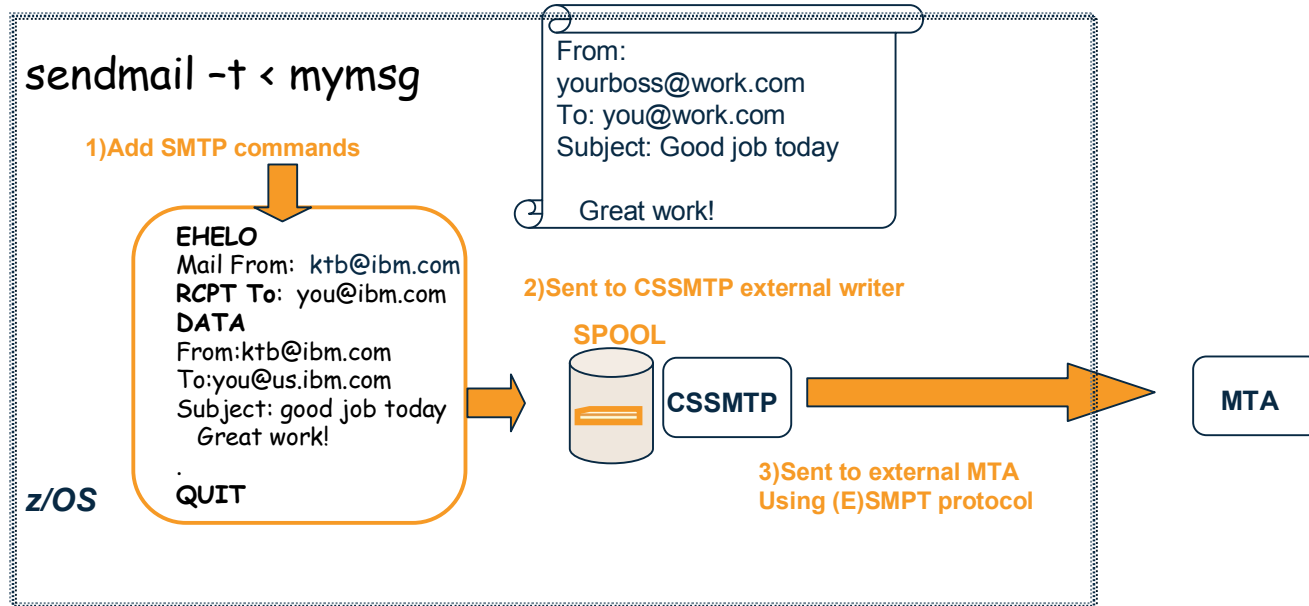
Addressing Impact of Removing Sendmail and SMTPD

- Removing platform provided SMTP server and Sendmail daemon (listeners) support. Users may consider:
    - A mail server on zLinux or other off-platform solution
    - Vendor-provided solutions that could run on z/OS (requires more discussion)

- Sendmail command is an SMTP client used to send mail
    - Propose "replacement" sendmail command that would perform as a "thin gateway SMTP client":
        - Would "transparently" allocate the mail message to spool and then transported with CSSMTP
        - Applications using the sendmail client could function seemlessly.
        - Would require some administrative changes to migrate to CSSMTP

Sendmail "Thin Gateway Client"

sendmail –t < mymsg

1)Add SMTP commands

From:
yourboss@work.com
To: you@work.com
Subject: Good job today

Great work!

EHELO
Mail From: ktb@ibm.com
RCPT To: you@ibm.com
DATA
From:ktb@ibm.com
To:you@us.ibm.com
Subject: good job today
  Great work!
.
QUIT

2)Sent to CSSMTP external writer

SPOOL

CSSMTP

MTA

**3)Sent to external MTA
Using (E)SMPT protocol**

z/OS

Addressing Impact of Migrating SMTPD to CSSMTP

Key Concern: "How to ensure my **production** mail workload will be processed successfully with CCSMTP"?
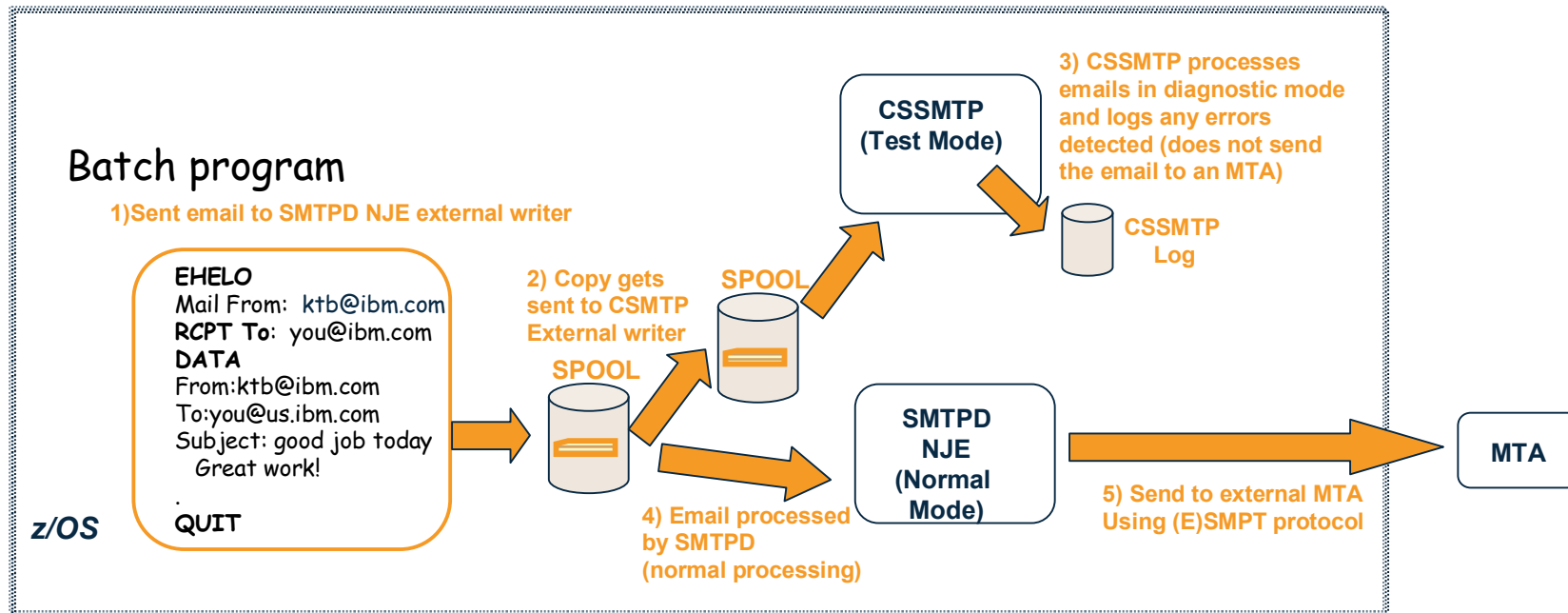
- No real way to perform a true test with production environment
- Many users aren't sure about all sources of mail

IBM will address migration requirements with migration aids:

- Allow CSSMTP to tolerate (ex: **Toleration Mode Option**) mail messages that may not be compliant with IETF standards in cases where SMTPD would have processed the message
  - Evaluate on case by case basis
  - **Best! Strongly recommend** users try to modify (fix) "noncompliant" messages.
    - ___Must Use Toleration Mode with caution:___ *If messages don't follow the IETF mail standards then very possible that over time as things change some mail server is introduced that will not send the message!!!*

- Allow for running SMTPD and CSSMTP (side by side) and processing the same sysout datasets with CSSMTP in "**Test Mode**"
  - SMTPD sends the mail as it does normally
  - CSSMTP processes the mail messages and produces a report indicating
    - *"success and would have sent or would have failed"*

SMTPD to CSSMTP Migration Aid with CSSMTP in "Test mode"

Batch program

1) Sent email to SMTPD NJE external writer

```
EHELO
Mail From: ktb@ibm.com
RCPT To: you@ibm.com
DATA
From:ktb@ibm.com
To:you@us.ibm.com
Subject: good job today
  Great work!
  .
  QUIT
```

z/OS

SPOOL

2) Copy gets sent to CSMTP External writer

SPOOL

CSSMTP (Test Mode)

3) CSSMTP processes emails in diagnostic mode and logs any errors detected (does not send the email to an MTA)

CSSMTP Log

4) Email processed by SMTPD (normal processing)

SMTPD NJE (Normal Mode)

5) Send to external MTA Using (E)SMPT protocol

MTA

Addressing Impacts: Reminders!

- Statements of Direction and Interface Change Notifications (ICNs) notify customers, vendors, and other IBM products as reminders

- Plans for Migration Health Checks in SMTPD and Sendmail to alert users to the removal of these applications
  - Roll back to V2R1

Thank You!

- IBM is interested in your feedback and how these changes and statement of direction with Mail on z/OS impact your enterprise.

  - Does this change cause a significant business impact to an existing process?

  Kim Bailey (ktekavec@us.ibm.com)